ALUMINUM

Project Fact Sheet

SELECTIVE ADSORPTION

BENEFITS

The process of removing sodium and other metal salts from molten aluminum could be completed in a small fraction of the time that is required using a molten cryolite bath. The potential benefits in terms of energy savings and reduced pollution would be substantial and include:

- saving nearly 2 trillion Btu/year of fuel in the U.S.
- total chlorine used reduced by a third thus saving 2 million pounds of chlorine annually in the U.S.
- reduced metal loss
- emissions reduction
- reduced corrosion of plant and equipment

APPLICATIONS

This project is aimed at the primary aluminum production sector. The salt adsorption media is a very new product, and is only now being introduced to the market for the adsorption of chlorine salts downstream in the aluminum production process. Project partners are investigating the potential of applying this material upstream in the process to adsorb fluoride salts as well.

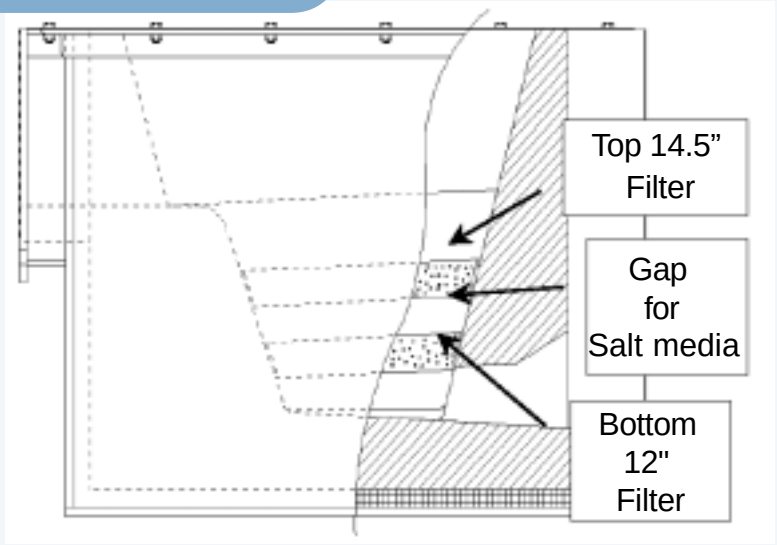
SELECTIVE ADSORPTION OF METAL SALTS FROM MOLTEN ALUMINUM

Primary aluminum is produced by the reduction of alumina in electrolytic cells. Cells contain a molten cryolite bath in which the alumina is dissolved. When a electric current is applied, aluminum is released and settles to the bottom of the cell. Molten aluminum is withdrawn to holding furnaces, and alumina is added to the bath as it is consumed. In normal production, a small portion of the bath is carried over with the molten aluminum. Most of the bath carry-over can be removed by careful skimming and good transfer practices. However, some carry-over of the bath to the metal holding furnace is common.

Cryolite bath contains sodium and small amounts of calcium and lithium. These metal salts must be removed from aluminum in the holding furnace to produce metal of commercial value. Chlorine is used to remove these salts. Bath carry-over is undesirable because it adds significantly to the time required and the amount of chlorine used to make commercial aluminum.

A new microporous material has been demonstrated to selectively adsorb salts from molten aluminum in holding furnace operations. This project will evaluate the potential of adapting these microporous materials to remove carry-over salts. Successful removal of these salts will result in significant reductions of energy, chlorine and metal loss.

SELECTIVE ADSORPTION



Filter bowl incorporating selective salt adsorbing media held between two foam filters.

Project Description

Goal: The goal of this project is to reduce by 50% the holding furnace time and amount of chlorine needed to achieve acceptable sodium levels in molten aluminum. The objectives are:

- Devise a convenient and practical method of introducing selective adsorption media to the metal during the transfer process between the reduction cell and the holding furnace. Ideally, this would include a filter for the removal of solid salts as well.

- Determine if the salt adsorption media can selectively remove molten sodium and other salts from molten aluminum before it is transferred to the holding furnace.

- Quantify the removal efficiency and the adsorption capacity of the media.

- Correlate the time needed to reduce the sodium content in the holding furnace with the salt content of metal coming in.

Progress and Milestones

- **Design** - Design and build modifications in the metal handling system to allow a bed of media to come into use. The main considerations are safety, the flow rate through the bed, temperature control and ease of operation.

- **Experiment** - conduct sets of experiments to study independent variables. These variables will be selected from media variables such as pore size, pellet size and bed size, and from process variables such as flow rate, metal temperature and salt chemistry. The salt and sodium level will be measured up and downstream from the adsorption bed. In addition to drawing chill mold samples for chemical analysis , a portion of the metal will also be poured into a mold. This metal will be remelted and treated in a small holding furnace. The time for degassing and sodium removal will be measured and correlated to the amount of cryolite bath carry-over.

- **Redesign and Experiment** - Perform second set of plant experiments. This allows the team an opportunity to make changes in the media or operational variables in response to lessons learned in the first experimental set.

Commercialization Plan

Selee Corporation will manufacture and sell the salt adsorption media. It is the leading producer of ceramic foam filters and related equipment and has a demonstrated history of bringing new products and developments to market quickly, especially in the primary aluminum and foundry industries.

PROJECT PARTNERS

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